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Pleshkov S. J.
Ural Federal University,
Yekaterinburg, Russia
E-mail: psj-5@yandex.ru

PROBLEMS OF POWER EFFECTIVE BUILDING IN YEKATERINBURG AND SVERDLOVSK AREA

Abstract. In article the results of economic calculations confirming profitability of long-term investments into power effective building in Uralsk region with application of power saving up technologies are resulted.

Keywords: power efficiency, energy efficient building, power effective building, passive building.

Плешков С. Ю.
Уральский федеральный университет,
Екатеринбург, Россия
E-mail: psj-5@yandex.ru

ПРОБЛЕМЫ ЭНЕРГОЭФФЕКТИВНЫХ ЗДАНИЙ В ЕКАТЕРИНБУРГЕ И СВЕРДЛОВСКОЙ ОБЛАСТИ

Аннотация. В статье представлены результаты экономических расчетов, подтверждающих выгодность долгосрочных инвестиций в Уральском регионе в энергоэффективные здания с применением технологий сохранения энергии.

Ключевые слова: энергоэффективность, здания с низким энергопотреблением, энергоэффективные здания, пассивные дома.

On one of forecasts [1], proceeding from technical potential of certain stocks fuel in Russia, the most accessible organic power resources should suffice: oil — for 40 years, gas — on 60, coal — more than on 1000. The coal-mining industry of Russia has enough problems, they well-known, hardly it is possible to expect real improvement of a situation without scale investment storm. In Russia in industrial production total amount the fuel and energy complex makes about 30 %. Thus more than third of fuel and energy resources extracted in Russia goes for export. Quite probably that we are at limits of certain physical possibilities of power resources of the country. Proceeding from rates of world consumption of energy [2], it is possible to assert safely that already in the XXI century mankind and Russians, in particular, will face intensive increase of power problems.

Russia occupies the greatest space in the world (17,098 million км^2) and is the coldest country of the world with mid-annual temperature of external air 5,5 °C, expenses for transport of power resources and a heat supply are very high [3].

Therefore, the problem of economy of fuel and energy resources in building branch — is the major problem of second half XX — the beginnings of the XXI centuries. Radically it can be solved only on the basis of economic appeal to investors. The conclusion of Conference of the United Nations on environment and development that on a XXI century threshold "the mankind worries turning point of the history" [4], is especially actual for Russia released from old ideological dogmas and leaving on a new way of development. Cargo of the problems saved up in the past and specificity of a transition period in economy predetermines complexity and morbidity of necessary transformations in building branch, transformations towards power effective building.

Fig. 1. The Southeast facade The first passive house, Constructed in Darmstadt

In Soviet Union the power savings problem in building dared basically for the account of application of protecting designs of the raised heat-shielding. In 1998 in Russia new requirements to a heat-shielding of buildings [5] are developed, power passports of buildings have started to be created. However till now universal transition to calculation for consumed thermal energy on indicators of heat metres is not made. It is obvious that in

Russia basic transition from quantity saved up for many years in other countries of volume of knowledge under power savings to new quality which should consist that principles of designing of a heat supply and air-conditioning the buildings, remaining invariable since 1970th years, should be based on building consideration as a uniform power system is necessary, and power strategy of power savings in buildings should be under construction on formation and realisation of stimulus of economical use of natural resources.

Object of studying in the given work is efficiency of use of energy in a building, thus the priority will be given to power saving up decisions which promote microclimate improvement of quality.

For this purpose we will consider concepts of energetically effective and non-polluting technologies: "a power effective building", "a building with zero use of energy", "a passive building".

Under power effective understand such building in which the effective utilisation of power resources is reached at the expense of application of innovative decisions which are realizable technically, proved economically, comprehensible from the ecological and social points of view and do not change a habitual way of life [6, 7]. To power effective buildings with low power consumption and buildings with zero power consumption can be carried.

The author of idea "the passive house" doctor Wolfgang Faist as follows considers the concept created by it: "the Passive house is a building in which the thermal comfort (ISO 7730) can be reached by additional heating or small amount cooling supply air which is required for achievement of normalised characteristics of quality of air — without necessity of additional recycling air" [8].

Passive houses outwardly do not differ from other buildings. Nevertheless, taking into account accurately certain power standard, they show high level of thermal comfort and extremely low consumption of energy.

The first passive house (Fig. 1) has been constructed in r-not by Kranihshtajn Darmstadt (Germany) in 1991.

Today houses constructed under the standard of the passive house, in Germany are accessible practically to everything as the additional expenses connected with their building, for 23 years have decreased with 50000 to 6000–15000 euros on one conditional apartment, and, for many-storeyed building of an expense it is much less, rather than, than for the individual house. Additional expenses quickly enough thanks to considerable economy of energy on heating in the conditions of systematically rising in price various types of fuel pay off. That is why only in Germany it is constructed already more than 30 000 passive houses, and in the USA, Europe, Japan — more than 50 000.

The positive indicator of profitability of building of passive houses is provided now thanks to offered investment programs. For example, the development bank "KfW" provides the organisations with credits for the sum over 50 000 euros under a concessionary interest rate for building of passive houses. According to the current legislation of Germany preschool child care centres, schools, educational institutions, High Schools are erected only under the standard of the passive house. Legislators prepare a package of laws which will oblige all building branch of Germany since 2020 to work only with the specified standard.

And how in Russia? In Russia there are no yet the building objects having certification of the standard of the passive house. There are economically defensible projects in the Moscow, Leningrad areas, in Nizhni Novgorod, Yekaterinburg in which principles, components, settlement techniques of the passive house are used. In 2009 the Federal law is passed "About power savings and about increase of power efficiency of buildings", in 2011 and in 2013 the Governmental orders "About the statement of rules of an establishment of requirements to rules of definition of a class of power efficiency of apartment houses" and "About modification of requirements to rules of definition of a class of power efficiency of apartment houses", power effective technologies stimulating development in building are published accordingly.

However, for today it is possible to designate some vital issues which are not allowing actively to develop power effective building and to erect the objects, completely satisfying to the standard of the passive house, basic of which — building cost.

In building branch of the Russian Federation decrease in the cost price of object is often reached for the account of use of building materials not most quality. In power effective building the good thermal protection is the first point on the importance, providing hermetic sealing of a building and protecting it from temperature fluctuations. If expanded polystyrene manufacture in Russia is mastered for a long time the new material of a neotime possessing higher isolating properties, is the exclusive sample of German concern BASF. Quality domestic neopor while considerably concedes to German manufacturers (bad caking of granules, non-uniformity in the sizes of granules, non-uniform foaming, etc.). Spray polyurethane elastopor, different from other materials durability, ease, in the least factor of heat conductivity and possibility of economy of space thanks to more thin insulation layer, accustoms while only at joint venture of Open Company "Elastokam" of Open Society "Nishnekamskneftehim" and BASF Polyurethanes GmbH. One of the most highly effective insulation materials — Styrodur — is made while only outside of Russia. That is, insulation materials with unique characteristics in Russia while or are not made, or made production not most quality. But this problem is solved, as demands only experience accumulation by the Russian manufacturers.

The second, not less important problem for which decision while very reluctantly spend means heads of building in Uralsk region: training of designers and builders. However, at high enough level at designing of passive houses and buildings with low and ultralow power consumption experts of Institute of the passive house in the Russian Federations working in close cooperation with German institute Passivhausinstitut — PHI are engaged in carrying out of training seminars, improvement of professional skill of experts, rendering of consulting services. It is obvious that low-skilled, underpaid the labour, in the majority involved of the countries of the Central Asian region, brakes process of transition of power effective building in the standard category.

The following problem. Reached maintenance of high tightness of a building at the expense of application high-quality insulation materials senselessly at presence of double-glazed windows not meeting modern requirements (Fig. 2) and the thermal bridges which are at the bottom of losses to 1/3 thermal energies.

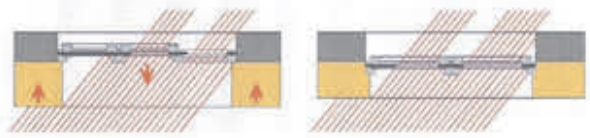

Fig. 2. Installation of double-glazed windows is made in such a manner that the sun warms an external part of a building, instead of internal more intensively

In the Russian Federation manufacture of the certificated double-glazed windows, satisfying to standards of passive housing construction, the Moscow company — Open Company "BiTri — the Connection" has mastered only. However made production not only concedes in quality to the European manufacturers, but also has very high price.

Thermal bridges divide on two categories. One can be avoided, with others in Uralsk region prefer to "be reconciled" ("Thermal protection of buildings" is told about thermal bridges and SNiP II-3–79 "Building the heating engineer" in Russian SNiP 23–02–2003). The Most vulnerable for cold bridges are ways of installation of doors and windows. Does not address proper attention on acting decorative elements of a building and balconies. Special insulation elements Schöck Isokorb® — armature with thermoloose leaves (Fig. 3) is made of high-grade stainless steel while only in German company "Schöck".

Access to innovative technologies on struggle against cold bridges allows to create in the European countries passive houses of not most ordinary configuration (Fig. 4).

Fig. 3. Bearing insulation the elements of company "Schöck" applied in building of passive houses

Fig. 4. Architecture of passive housing construction in Cologne (Germany)

Listed above a problem have the best effect of the decision if all problem components are considered and improve consistently.

Whether so probably power effective, economic building answering to standards of the passive house in Yekaterinburg and in Uralsk region? Without any doubts — yes.

The author had been conducted research in which result expenses on heating of premises in Yekaterinburg different quality of construction within 3th years were studied. Results are shown in Table [9, 10].

The analysis of research of expenses of proprietors of habitation on premises heating

The characteristic the inhabited Premises	Expenses of proprietors of habitation on premises heating, rbl.				Market cost of apartments as of December, 2011	Presumable cost of apartments in the house constructed in the passive standard (for 12.2011)
	2012	2013	2014	Total for 3 years		
Two-room apartment, the panel house, it is installed gas, a total area of 48,0 sq. m. Year of construction 2000.	13081,56	13124,22	14311,13	40516,90	2700000 rbl.	From 3105000 to 3240000 rbl.
One-room apartment, the house it is installed gas, the monolith, is available own boiler-house, a total area of 40,8 sq. m. Year of construction — December 2011.	6361,81	5817,29	4364,90	16544,00	2000000 rbl.	From 2300000 to 2400000 rbl.

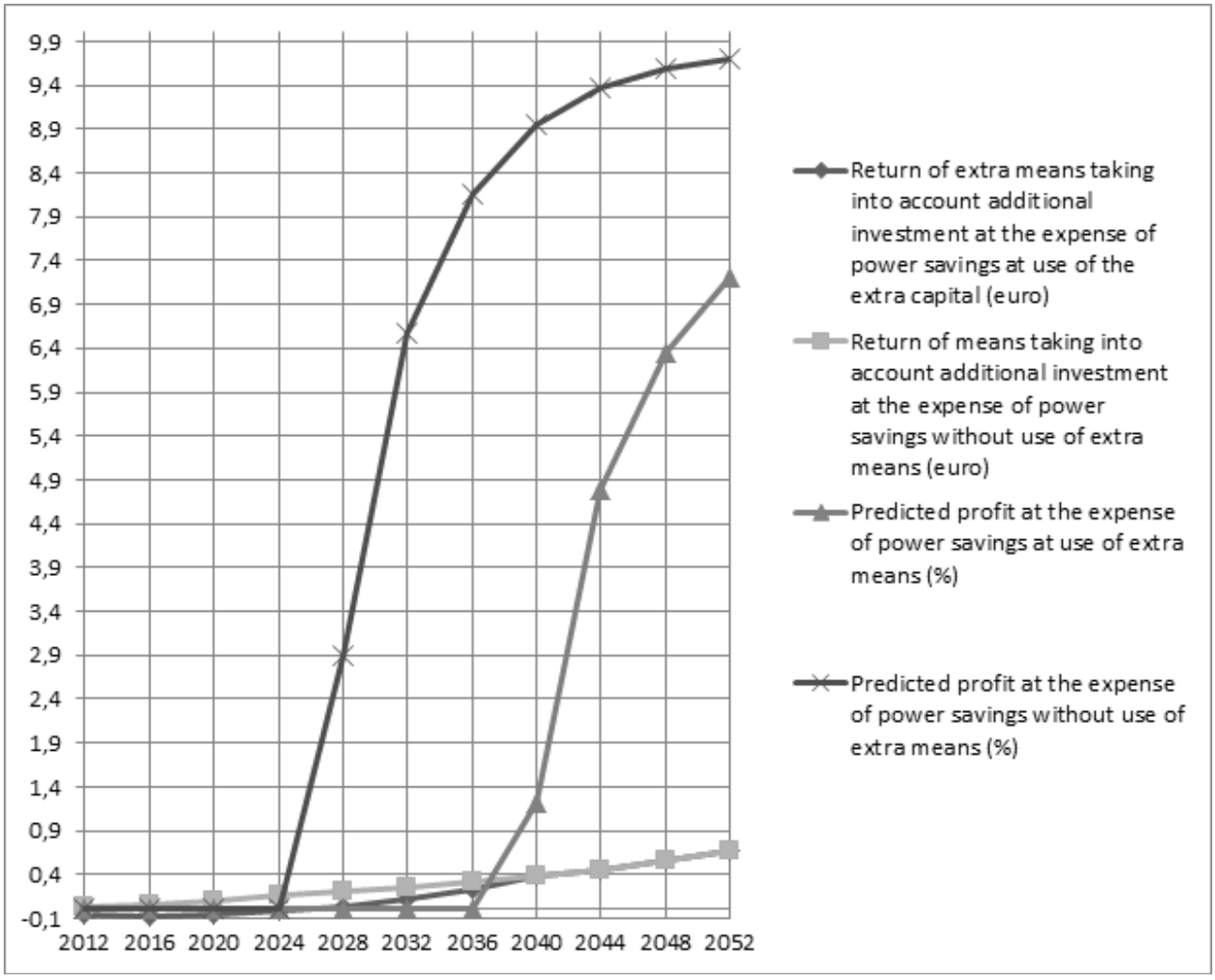

Fig. 5. Dynamics of return of extra means at long-term investments and predicted profit at the expense of power savings at use of the extra capital and without use of extra means

Notes to Fig. 5. Flowing (2012) adjusted price of power resources in the world market is accepted 9,6 ct/KWh. Annual rise in prices for power resources in the world market is accepted 5 %. Flowing (2012) adjusted price of power resources in Russia is accepted 3,0 ct/KWh. Predicted growth of global cost of power resources of 5 %

Building of passive houses in Germany was made even now at cost to building of usual objects (in certain cases the difference at cost makes 10 %). In more frigid climate of Russia, naturally, expenses will increase approximately on 15–20 %. At an existing rate of inflation in Russia and a rise in prices for real estate by 2025 only at the expense of decrease in expenses on heating in the first case 58,37 % of an overpayment for more expensive habitation, in the second — 35,92 % will pay off.

If to use a technique of calculations (under the given permission experts of design-consulting institute "Luwoge consult", Ludwigshafen (Germany)) it is possible to ascertain, an economic return on building of inhabited objects in the standard of the passive house with attraction of the extra capital in 25 years; building for the account of own means will pay off in 10 years (Fig. 5). The Main role will be played by the price for power resources.

CONCLUSIONS

Russia is necessary political decisions on the higher state and the regional levels, stimulating power effective building for the purpose of maintenance of power safety of the country.

In educational programs of higher educational institutions of Russia participating in preparation of experts of building branch, it is necessary to make the changes connected with studying of discipline "Power efficiency in building".

Long-term investments into power effective building into Uralsk region with application of power saving up technologies are profitable.

For experts of building branch, science officers of the Ural region are necessary scientific and business contacts to the leading European organisations working in sphere of power effective building for the purpose of practical studying of standards of "the passive house" and the

further investment of means in building of power saving up inhabited objects.

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